The American Fertilizer

Vol. 100 JANUARY 1, 1944 No. 1

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...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

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Potash in War Production*

By J. W. TURRENTINE

American Potash Institute, Washington, D. C.

THE essentiality of potassium salts in American agricultural and chemical industries is a matter of general knowledge. With abundant supplies of a wide variety of materials readily at hand since the end of World War I and up to the present, there has been little occasion to analyze the nature of that essentiality. Now for the first time during that period we are confronted by a prospective deficiency in supply, which gives point to that analysis if we are to deal with the situation wisely and effectively.

One year ago it was my privilege to address this division on the subject "The Wartime Contribution of the American Potash Industry," describing the development of that industry and its success in expanding its output to keep ahead of the expanding demand—a normal expansion in demand resulting from the rapid spread of scientific practices in American agriculture, suddenly accelerated by the war emergency (with the termination of European potash importations) and by the food and fiber demands of the American people gainfully employed and with money to buy the food and clothing more nearly in the quantities required. Superimposed were the demands of the largest army in American history and the best-fed army, I dare say, in world history, expanded further by Lend-Lease requisitions to help feed our Allies and the stricken people of war-devastated nations within reach of our munificence. The potash industry has sustained its record with increased output, despite the difficulties of wartime restrictions.

*Presented before the Division of Fertilizer Chemistry at the 106th meeting of the American Chemical Society, Pittsburgh, Penna., and reprinted from "Chemical and Engineering News," Nov. 10, 1943, issue.

Allocations of Potash

During the 12-month period, April 1942 to March 1943, the American industry delivered 1,320,000 tons of potash salts equivalent to 700,000 tons of K_2O, a 20 per cent increase over the preceding 12 months, thus with 23,000 tons of muriate imported from Russia supplying the agricultural and chemical industries with the largest tonnage in their history. According to all estimates of less than a year ago, this would prove ample for North American requirements including Canada, Cuba, Puerto Rico, and Hawaii. As formerly, the major part of this tonnage was in the form of highly refined potassium chloride, known in the fertilizer trade as 60 per cent muriate.

This performance was no accident, but was the result of careful planning and remarkably accurate forecasting of North American requirements. In view of restrictions through priorities on materials of construction and repair and the ever-mounting scarcity of skilled labor, the development of surplus production capacity beyond the absolute needs of the day and the predictable early future was definitely against public policy as dictated by federal war agencies. The objective, therefore, was a margin between supply and demand designed as insurance against the unhappy consequences of interrupted production. It did not and could not contemplate demands extraneous to the North American requirements on which its operations were based.

The allocation of this tonnage among buyers was undertaken as a function of the War Production Board early in 1943. First, the chemical industry was granted priority. With respect to the fertilizer industry, the policy was established of basing allocations on the record of purchases of the two prior years.

Among the would-be purchasers seeking allocations were those whose foresight prompted full regard for safety margins, thus adding a possible element of the fictitious to the apparent demand. Others, however, with authority derived from broad international commitments, received first consideration with an allocation of 72,000 tons of 60 per cent muriate for the United Kingdom under Lend-Lease; others, 10,000 tons for Puerto Rico agriculture undergoing attempted rehabilitation, and still others. These prior allocations completely wiped out the safety margin and for the first time brought about a real deficit in supply. The Agricultural Adjustment Administration bidding for 50,000 tons K_2O for its improved pasture and legume programs, withdrew entirely in favor of cash crop requirements. Allocations announced on the basis of the 10-month, so-called "contract season" instead of a full year's purchase further accentuated the deficit.

The War Production Board is allocating this 700,000 tons of K_2O for the 1943–44 delivery period as follows:

AGRICULTURAL

36,000	United Kingdom
35,000	Canada
4,000	Latin American and others
540,000	United States, Puerto Rico, and Hawaii

CHEMICAL

85,000	United States (includes 7,500 tons of K_2O equivalent as caustic, also allocated for export to United Kingdom)

This represents new allocations to the United Kingdom of 36,000 tons of K_2O for agricultural use and 7,500 tons for chemical use, a total of 43,500 tons of K_2O or 72,000 tons of 60 per cent muriate, withheld for export under Lend-Lease if the equivalent cannot be obtained from Palestine, Spain, and Russia. The allocation to chemical industries of 85,000 tons of K_2O represents an increase of 17,700 tons over the 67,300 tons of K_2O delivered to those industries during June to May, 1942–43.

Approximately 88 per cent or 476,730 tons of the remaining 540,000 tons of K_2O for agricultural use in the United States, Puerto Rico, and Hawaii has been allocated to the several individual fertilizer-mixing industries for delivery to them during the 10-month period, June through March 1943–44 (period 2, the so-called "contract season"). These allocations are based on corresponding deliveries during 10-month periods of 1941–43.

The remaining 12 per cent is to be allocated for delivery during April and May 1944 (period 3, the so-called "spot season"). The War Production Board conservatively advises that this supplemental allocation be estimated at 10 per cent of that allocated for the 10-month period, although it is confidently expected that it will be nearer 15 per cent. But on the 10 per cent basis, the 12-month allocations, June through May 1943–44, in the several categories of potash salts as compared to deliveries of the two preceding years, are detailed in Table I.

Allocations so far announced by the War Production Board are only for the 10-month period, and additional quantities remain to be assigned. This has not always been understood and may account for exaggerated statements as to the potash shortage. This tabulation indicates that the shortage for 1943–44 may amount to as much as 60,000 tons of K_2O (approximately 10 per cent) as compared to 1942–43, but an increase of 9,200 tons as compared to 1941–42. It is obvious that the most effective way to improve the supply situation is to provide British requests from less restricted sources, for the stringency in supply arises principally from the diversion of 60 per cent muriate from our food program. This raises the question, as yet unanswered, whether that diverted tonnage would better serve the joint war effort if used on American soils where potash requirements and responses are both high.

TABLE I

POTASH ALLOCATION FOR AGRICULTURAL USE IN THE UNITED STATES, PUERTO RICO AND HAWAII FOR 1943–44 AND DELIVERIES FOR 1942–43 AND 1941–42

Salts	1943–44		1942–43		1941–42	
	10 mos.	12 mos.	10 mos.	12 mos.	10 mos.	12 mos.
	Tons K_2O		Tons K_2O		Tons K_2O	
60% muriate	349,604	388,449	414,943	461,047	369,0	410,049
50% muriate	40,142	44,602	33,162	36,847	29,275	32,528
25% manure salts	42,200	46,889	43,264	48,071	33,266	36,962
Sulphate (50%)	34,829	38,699	32,981	36,645	30,723	34,137
S. P. M. (22%)	9,955	11,061	6,591	7,324	6,228	6,920
Total	476,730	529,700	530,941	589,934	468,536	520,596

Nor are we yet at the end of our rope. All American producers are assiduous in seeking increased efficiency; one is now surveying plans for a substantial increase in refining capacity; another is exploring by core drilling the newly discovered potash deposit in eastern Utah. However, to develop a new mine and install a refinery two years' time might be required, providing no immediate relief from the present stringency. Last winter we imported 23,000 tons of 60 per cent muriate from Russia and now have 20,000 under contract with option on an additional 20,000 tons. The process of increasing supplies is still being pursued, although its outcome cannot be predicted.

Significance of Potash Deficit

So, while the supply situation is bad enough to call for close scrutiny, it is not so bad as it has been represented, nor is it beyond repair. What is the real significance of this deficit in terms of production of essential crops and what is its bearing on our production program?

First, it is necessary to define the dimensions of our deficit. There is no reliable measure of the amount of potash that would now be consumed if the supply were unlimited. In the words of Firman E. Bear, of New Jersey, quoted from a private communication: "We have just begun to recognize the tremendous significance of potash in our agricultural economy." Truog, of Wisconsin, states: "Our tremendous production of legumes . . . is calling for more and more potash and unless we get these additional amounts, it will be difficult to step up or even continue our present production of legumes which are the foundation of our whole agriculture in Wisconsin."

The War Production Board states that "the fertilizer industry requested 940,000 tons of high-grade muriate." This is equivalent to 564,000 tons of K_2O, 176,000 tons more than the 388,000 tons of that preferred grade allocated to U. S. agriculture, but only 34,000 tons more than the total of 530,000 tons of all grades to be allocated.

Somewhere between these two extremes lies the immediate purchaser demand, influenced, however, by reluctance to buy the more expensive lower grades and by consideration of stockpile safety margins. The War Food Administration estimates our 1944 potash requirements at 877,000 tons of K_2O, if we are "to obtain capacity agricultural production." Canada, asking for 50,000 tons of K_2O was allocated 35,000 tons, which is 5,000 tons below the 40,000 tons used last year.

The expansion called for in crop production connotes a corresponding expansion in potash consumption, for it is well demonstrated that the surest, quickest, and cheapest method of increasing crop production is by means of adequate fertilization—fertilization with mixtures of proper ratios, at optimum rates of application, most effectively placed. This fact takes on added significance today when farm labor is scarce, wages are high, and gasoline and rubber for farm machinery are restricted to the most essential uses.

In emphasizing this fundamental principle, Scarseth estimates that his state of Indiana "alone has the potentiality of producing 85,000,000 more bushels of corn and 32,000,000 more bushels of wheat, oats, and soybeans and 800,000 more tons of tomatoes annually" all without plowing up a single additional acre. To "supply maximum soil fertility for highest possible production of crops," he arrives at the figure of 375,000 tons of K_2O as contrasted with 30,600 tons used in 1941. On such a basis, the Indiana potash deficit alone is some 340,000 tons of K_2O.

Yoder, of Ohio, adds his support:

Increasing acre yields—that is, increasing production by vertical expansion—is a sound, fundamental method of increasing production of both food and feed crops; it is conserving of land, labor, and machinery. The importance of commercial fertilizers in effecting increased acre production has been carefully evaluated during four decades of research by the State Agricultural Experiment Station. The validity of the results obtained has been thoroughly tested and verified by tens of thousands of Ohio farmers. This wealth of factual information must be utilized if production goals are to be approached.

The following gains may be expected on the basis of Ohio experience: (a) 114,000 tons additional fertilizer will give 17,500,000 bushels additional corn production at a fertilizer cost of 25 cents per bushel; (b) 62,000 tons additional fertilizer applied on small grains seeded to hay crops will give 270,000 tons additional of hay, 2,300,000 additional bushels of wheat, and 1,130,000 additional bushels of oats (nearly $6,000,000 worth of feed and food products at a fertilizer cost of $2,000,000). The residual effects of the additional fertilizer will give an extra million bushels of soybeans without acreage expansion. These prospective gains illustrate vertical expansion.

Thomas, of Maryland, estimates that if the 1,570,000 acres which may be best utilized for crop production in his State were fertilized

with grades designed for maximum crop returns at rates providing optimum plant food requirements, some 297,000 tons of fertilizer would be required, an increase of 160,000 tons over the 137,000 tons usually applied, to yield probable increases of 23 per cent for corn, 47 per cent for wheat, 16 per cent for soybeans, 50 per cent for pastures, 23 per cent for potatoes, 20 per cent for tomatoes, etc.

Truog, of Wisconsin, estimates the potash needs of his State at 50,000 to 100,000 tons against the 10,000 tons allocated. Sturgis, of Louisiana, estimates the needs of his State at 50,000 tons against the 10,000 now used.

Add these to analogous figures from the many other states where potash use falls short of the optimum, as demonstrated by the respective state experiment stations, and there results a total of such dimensions as to show the essentiality of extreme wisdom in potash allocation and how far we have to go before our soils are brought up to their maximum productivity.

But even if we had such a potash tonnage at hand, we still could not attain these maximum yields, for, as Bauer and Scarseth are careful to emphasize and as we all know, potash to be used efficiently must be used in the proper ratio to nitrogen and phosphorus, which again for the country as a whole runs into startling figures as compared to present usage, definitely beyond our present capacity to produce.

As compared to 1942–43, there is prospect of a 10 per cent deficit for the current year, some 60,000 tons of K_2O equivalent to 100,000 tons of 60 per cent muriate. What does this mean in terms of our wartime crop-production efforts? The answer is to be found in state experiment station data and the following analysis is based thereon. The figures here cited are taken from a survey as yet incomplete which is designed to show the agronomic and economic significance of potash in our war food program. The crops specified are those designated by the War Food Administration as of major importance for food, fiber, and vegetable oils.

In presenting this picture it is sufficient to see the crop yields which could be added with the use of this 60,000 tons of K_2O at demonstrated rates of application, and, as a corollary, the yields which must be lost because of this deficit. These increases represent acres already under cultivation whose rate of production can be increased more nearly to the optimum—vertical as contrasted to horizontal increases in production, of special wartime significance, for it is well known that labor and machinery supplies are inadequate for the best cultivation of the acreages already employed. It is a pertinent answer also to those who dismiss our food problem by saying, "we must plow up an additional 40 to 45 million acres."

Returns from Potash

Beginning with Illinois, you are familiar with the elaborate summaries and analyses of data obtained from experimental fields recently issued by Bauer and associates. Bray's potash map shows that the soils of the southeastern part of that State are relatively potash-deficient, comprising some 15 per cent

(Continued on page 22)

TABLE II

SIGNIFICANCE OF ADDITIONAL POTASH IN AMERICAN FOOD PROGRAM

Crop	State	Present Area in Crop Acres	Additional K_2O Needed Per Acre Lbs.	Additional K_2O Needed Total Tons	Increased Yield Produced	Total Value of Crops	Value of 1 Ton, 60% Muriate in Crop Equivalent
					Bushels		
Potatoes	Maine	200,000	80	8,000	2,400,000	$2,592,000	$324
	N. C.	100,000	60	3,000	1,200,000	1,524,000	508
Peanuts	N. C.	300,000	15	2,300	10,100,000 lbs. nuts	545,400	237
Sweet potatoes	N. C.	85,000	40	1,700	1,700,000	2,176,000	1,280
					Pounds		
Cotton	N. C.	850,000	20	8,500	24,650,000 lint	4,856,050	
					9,860,000 oil	1,257,150	Av. 758
					17,255,000 meal	333,021	
Cotton	S. C.	1,100,000	15	8,200	46,200,000 lint	9,240,000	
					18,480,000 oil	2,356,200	Av. 1,490
					32,340,000 meal	624,162	
					Bushels		
Corn	Indiana	4,300,000	30	64,500	43,000,000	37,410,000	580
Wheat	Indiana	1,100,000	20	11,000	3,300,000	4,356,000	396
Tomatoes	Indiana	50,000	30	800	400,000,000 lbs.	2,680,000	3,350
Hay	Indiana	1,000,000	30	15,000	500,000 tons	7,720,000	514

Effect of Adding Sodium to the Fertilizer on Cotton

By H. P. COOPER* and W. H. GARMAN**

THE capacity of the cotton plant to utilize sodium probably accounts in part for the increase in yields secured from the use of fertilizers containing this element.

The data in Table I gives the comparative yield of seed cotton at the Sandhill Station on Norfolk loamy soil at different levels of potash fertilization when sodium was added to the fertilizer. There were four series of 14 plots each, or a total of 56 plots. All check plots received 600 pounds of 5–10–5 fertilizer before the crop was planted. The nitrogen applied under the check plots was derived equally from cottonseed meal and ammonium sulphate and side-dressed with 15 pounds per acre of nitrogen from sodium nitrate. All other treatments were in quadruplicate and received the equivalent of 600 pounds per acre of a 5–10–0 fertilizer in addition to potash at the rates of 0, 15, 45, and 60 pounds per acre. A side-dressing of 15 pounds of nitrogen was made after chopping. One-half of all plots received nitrogen in the form of sodium nitrate, the other half received the nitrogen from calcium nitrate or Cal-Nitro.

There is a progressive percentage decrease in the yield of seed cotton from the use of sodium coincident with the increase in rate of potash fertilization. Where no potash was applied, the addition of sodium increased the yield 215 pounds of seed cotton per acre, or 70.3 per cent; whereas, with 60 pounds of potash the increase from the use of sodium was 182 pounds, or 15.1 per cent.

The comparative yields for the first and second five-year periods are shown in Table II. Where no potash and 15 pounds of potash were applied, there were decreases of 213 and 139 pounds of seed cotton respectively for the second five-year period; whereas, with 30 or

TABLE I

INCREASE IN YIELDS OF SEED COTTON FROM ADDITIONS OF SODIUM IN NITRATE OF SODA, AVERAGE FOR 10 YEARS

Pounds of potash, with and without sodium	Yields of seed cotton	Increase for Sodium		Increase yield over plots not receiving potassium or sodium	
		Pounds	Per cent	Pounds	Per cent
No potash:					
No sodium...	306				
Sodium.....	521	215	70.3	215	70.3
15 lbs. of potash:					
No sodium...	742			436	142.5
Sodium.....	943	201	27.1	637	208.1
45 lbs. of potash:					
No sodium...	1093			787	257.2
Sodium.....	1280	187	17.1	974	318.3
60 lbs. of potash:					
No sodium...	1201	.....		895	292.5
Sodium.....	1383	182	15.1	1077	351.9
30 lbs. of potash:					
No sodium...	1038			732	239.2
Sodium*.....	1144	106	10.2	838	273.9

*The check plots received 30 pounds of N equally from cottonseed meal and ammonium sulphate under the crop, and a side-dressing of 15 pounds of N as nitrate of soda. Therefore, they received one-half the sodium added to the other plots which received sodium.

TABLE II

COMPARATIVE YIELDS FOR FIRST AND SECOND FIVE-YEAR PERIODS FROM USE OF SODIUM DERIVED FROM SODIUM NITRATE

Treatment[1]	Average yields seed cotton per acre		Decrease or increase for second period	Average difference
	1931–1936* Pounds	1937–1942* Pounds	Pounds	Pounds
No potash:				
No sodium....	391	224	—167	
Sodium.....	612	352	—260	—213
15 lbs. of potash:				
No sodium....	814	670	—144	
Sodium.....	1009	875	—134	—139
45 lbs. of potash:				
No sodium....	1023	1163	140	
Sodium.....	1203	1332	129	134
60 lbs. of potash:				
No sodium....	1085	1318	233	
Sodium.....	1213	1533	320	276
30 lbs. of potash:				
No sodium....	1009	1066	57	
Sodium**.....	1066	1224	158	107

[1]All plots received 45 pounds of N and 60 pounds of P_2O_5 per acre.

*Yields were not taken in 1933 and 1941.

**The check plots received only half the amount of sodium received by other plots receiving sodium.

Note: Condensed from 55th Annual Report, pages 144–148, S. C. Experiment Station.

*Director, S. C. Experiment Station.

**Assoc. Soil Scientist, S. C. Experiment Station.

more pounds of potash there were increases in yields for the second five-year period. These data suggest that around 30 or more pounds of potash per acre are required to maintain the yields of cotton in continuous culture on this soil.

The yield data and the chemical analysis of plants definitely suggest that the addition of sodium to the fertilizer may have a significant effect upon the production of cotton, particularly where the soil is relatively low in available potash. The available data on the relation of the use of sodium and potassium by the cotton plant indicate that, after the addition of approximately 25 pounds of potash to the soil, sodium may be almost as effective as additional potash in increasing the yields of cotton on many soils.

A lack of consideration of the capacity of the cotton plant to utilize sodium where potash is deficient has led to a general misinterpretation of certain experimental data on cotton fertilization. The data presented may be helpful in interpreting the large increase in yields and the absence of potash deficiency symptoms in experiments involving the application of varying amounts of potash when sodium was also included in the fertilizer.

TVA Reports Fertilizer Developments

In the report on the year ending June 30, 1943, the Tennessee Valley Authority emphasized the contributions made to the war effort by the various activities of that organization. Among the developments affecting the fertilizer industry were the following:

Nitrogen Fertilizer.—Curtailment of demand for ammonium nitrate for explosives enabled production of 13,600 tons for agricultural use.

Phosphatic Fertilizers.—Of 77, 300tons of concentrated superphosphate shipped from the Muscle Shoals plant, 54,000 tons was provided for Lend-Lease; actual production was 60,200 tons of concentrated superphosphate and 7,300 tons of calcium metaphosphate containing 65 per cent of available plant food. "The demand for high concentrated phosphate plant food products, such as developed by TVA, was dictated in large part by scarcity of ocean shipping, since one shipload of TVA phosphate applied to the soil was estimated to equal several shiploads of foodstuffs."

Dicalcium Phosphate.—At the close of the fiscal year, TVA was preparing to produce 15,000 tons annually of dicalcium phosphate for use as a mineral supplement in stock feed, to help make up for shortages of bone meal resulting from decreased imports. Research by State agricultural experiment stations showed the TVA product is satisfactory for direct feeding to livestock.

Phosphates and Food Production.—"While military needs have first call upon phosphorus production facilities, the cumulative date of eight years of test and demonstration indicate that every bit of the excess over and above front-line demands can be applied to the soil with the prospects of positive returns measured in increased food production and nutritive value of the product." TVA reported approximately 4,700 additional farms took up the test-demonstration program, making a total of 44,000 for eight years in 29 States.

A Tennessee Agricultural Extension Service report was cited, showing that a sampling of 94 test-demonstration farms showed a 32 per cent increase in production of milk, meat, and eggs with no increase in labor required between 1936 and 1940. As compared with 16 pounds of phosphate per acre used on these farms, 32 counties having no test-demonstrations used three pounds per acre and increased production by six per cent; in 62 counties having test-demonstrations, the average application was five pounds and production increased 12 per cent; test-demonstration areas, where entire communities participate, an average of nine pounds was used and production increased by 20 per cent.

Other instances were cited, including figures from 14 Huron County, Ohio, test-demonstration farms showing an increase of 30 per cent in number of animal units while the county as a whole showed no change; in addition, livestock efficiency increased, examples being 38 per cent increase in butterfat sales per cow, 11 per cent increase in lambs raised per ewe, 12 per cent increase in eggs sold per hen, and 66 per cent increase in milk and cream sales per cow.

TVA provided phosphates for experiments on the King Ranch in Texas in cooperation with the Texas Agricultural Experiment Station and the U. S. Bureau of Animal Husbandry. A square mile of phosphated range supported 62 heifers as compared with 43 on a similar untreated area. In the first year, the average gain per animal on the phosphated land was 87 pounds greater than on the untreated range. The heifers on the phosphated land produced a calf crop of 91 per cent in the second year, as compared with 83 per cent on the untreated land, and the calves on the

phosphated land weighed 342 pounds on June 1st as compared to 318 pounds on the unphosphated range.

The report said, "Soils scientists have pointed out that four-fifths of the soils of the United States are deficient in phosphorous," and symptoms of phosphorous deficiency in farm animals have been noted in a number of States.

"Present phosphatic fertilizer manufacturing capacity does not allow the nation to take full advantage of the increased production of food made possible by this element," the report said. The annual capacity of the industry in the United States is 1,712,000 tons, which would need to be doubled to supply to American agriculture generally the amounts found to increase food production by 30 per cent on test-demonstration farms using TVA fertilizer, it added.

Mobile Phosphate Plant.—The TVA completed general foundation and other investigations at a site acquired on the Gulf Coast for construction of a phosphorous plant authorized by Congress on June 27, 1942, to meet in part the shortage of productive capacity caused by wartime phosphorus demands. The site was chosen largely to facilitate post-war water transportation of raw materials from Florida phosphate beds and of finished fertilizer to Middle Western States where use has been restricted by high delivered costs. Construction was not commenced because of lack of WPB priorities for critical materials.

New Fertilizer Developed in Palestine

After many years of practical and scientific experimental work, a new fertilizer based on bacterial action has recently been put on the market in Palestine by the American Near East Corporation of Tel Aviv. The product, called "Nitrophos," was first made by Dr. S. Kurz, a local agricultural engineer, whose work has been improved on by the corporation with the help of new American patents. The fertilizer is based on a bacteria-inoculating process whereby organic farm and city waste are treated with bacteria cultures. Crude garbage, bones, etc., are dumped into digesters and a small amount of a new type of bacterium is added. The bacteria are grown on specially chosen and prepared soil. While the natural process of soil fermentation takes between eight and twelve months, the new process has reduced it to 48 hours. Experiments with Nitrophos have been made on over thirty farms, agricultural schools, and in the Jewish agricultural settlements during last winter and spring with good results. It has been used on vegetables (including potatoes), citrus and other fruit trees, green fodder, and barley.

New Pasture Fertilizer Booklet

The National Fertilizer Association has issued an attractive 16-page booklet entitled "Food, Feed and Fertilizer," for the use of its members in spreading the gospel of pasture fertilization. Prepared by R. H. Lush and H. R. Smalley of the Association Staff, the information contained has been summarized by the authors as follows:

"During the past two years the number of livestock has increased more rapidly than total feed production, resulting in a critical shortage of feed.

"Livestock products furnish 46 per cent of our national food requirement, measured in calories, but 59 per cent of the protein, 81 per cent of the calcium, 62 per cent of the phosphorus, and a large part of the essential vitamins.

"Pasture, hay, and other forage crops supply 60 per cent of all the feed required by all livestock but milk cows get 76 per cent of their feed from these crops, other cattle 80 per cent, horses and mules 67 per cent, sheep 95 per cent. Hogs and poultry get 95 per cent of their feed from grain.

"The feed shortage is most severe in the East where production of milk and poultry is concentrated and in the South and West where grain production is limited. Most of the hogs are in the Middle West where grain production is heaviest.

"With the exception of feed for poultry, the shortage can, to a large extent, be met by the improvement of pastures and by growing more and better quality hay and forage.

"The cost of producing feed in the form of pasture and hay is much less than the cost of producing grain and this is especially true of the labor cost.

"The results of many experiments show that yields of pasture and hay can be increased very greatly by proper use of fertilizer, and lime where needed, and that the increases obtained are very profitable.

"On many soils, use of fertilizer and lime improves the quality of pasture and forage crops to such an extent that cattle, horses, and sheep can tell the difference between the fertilized and unfertilized crops."

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PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

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Principal Articles in This Issue

Fertilizer Outlook Good

The present prospect is that during the year ending June 30, 1944, more fertilizer will be produced, distributed, and used on American farms than in any previous year. Figures published by The National Fertilizer Association indicate a total consumption of all kinds of fertilizer in excess of 11,000,000 tons. Last year's consumption was about 10,500,000 tons; in 1940 it was less than 8,000,000 tons. The Association represents nearly 400 active member companies, operating more than 500 of the country's 900 fertilizer mixing plants.

However, in view of labor shortages in fertilizer plants and transportation difficulties, it is wise for every farmer who has a dry place in which fertilizer can be stored to order it now and have it delivered as early as possible. It is necessary to keep fertilizer moving if the heaviest demand in all our history is to be met.

Agriculture is now the nation's No. 1 consumer of chemical nitrogen—war is No. 2 and industry No. 3. This has been made possible by a very large expansion of our air-nitrogen industry both by the government and by private industry, and by continued importations from Chile and from Canada.

Last year 460,000 tons of actual nitrogen were used as fertilizer, 204,000 tons as side- and top-dressings, and 256,000 tons in mixed fertilizers. Government agencies now give assurance that 625,000 tons of actual nitrogen will be available for fertilizer use this year—35 per cent more than last year. Of this total, 271,000 tons will be available for side- and top-dressing, 354,000 tons for use in mixed fertilizer.

There will be about as much nitrate of soda for direct use as last season. Ammonium sulphate will be used entirely in mixed fertilizers except in the West where it will be available for direct use or for mixing, but there will be larger supplies of Cyanamid, Uramon, and ammonium phosphate than in either of the past two years. There will also be Cal-Nitro, formerly imported from Norway and Germany and now produced in this country.

Ammonium nitrate containing 32.5 per cent of nitrogen is now being produced in quantity in a number of government plants in this country and Canada and by one private plant in California. About 230,000 tons have been allocated for direct use, and will be available to farmers in all parts of the country.

Production of superphosphate has been increasing steadily month by month in existing plants, some stand-by plants have been reopened, and construction of some new plants

has been authorized. Production of normal superphosphate in 1942 was 5,144,484 tons basis 18 per cent. The present rate of production indicates a total output of over 6,500,000 tons for the 1943–1944 fertilizer year. It is estimated that about 6,000,000 tons of this will be distributed by the fertilizer industry in mixed fertilizer and as superphosphate, and the rest by AAA in its grant-of-aid program. About 300,000 tons of concentrated superphosphate will be produced, something more than a third of which will probably be exported under Lend-Lease.

Domestic potash plants are producing about 700,000 tons of actual potash this year as compared with about 380,000 tons produced in 1940, but even so there will not be enough to supply the fertilizer demand. The average potash content of all mixed fertilizers sold last year was just over 7 per cent as compared to 6 per cent in 1939 and 1940. With an increased tonnage of mixed fertilizer to be manufactured this year, it is expected that the potash content will average about 5.5 per cent—about the same as 1936. The nitrogen content of mixed fertilizers will be increased substantially, and phosphoric content will remain about the same.

The Office of Price Administration has issued the Second Revision of MPR 135 which sets dollars-and-cents prices for each permitted grade in each State substantially at present levels.

Supply of Sulphur Adequate

The American sulphur industry, at the conclusion of a year in which all wartime demands were met in full at no price increase, begins 1944 with productive capacity and stocks sufficient to fill Allied needs during the expected final industrial and military offensive against the Axis, according to Langbourne M. Williams, Jr., president of Freeport Sulphur Company, this city. Mr. Williams added:

"Shipments from mine to consumer declined in 1943 from the all-time high of 1942. Domestic and foreign shipments were estimated at approximately 3,000,000 long tons compared with 3,121,122 tons in the preceding year. Production also declined to an estimated 2,500,000 tons from 3,455,966 tons in 1942. Stocks at the mines were reduced by approximately 500,000 tons but, coupled with large productive capacity, are still ample to meet the full anticipated war needs of the future."

L. W. Rowell Retires

After a career of 48 years with Swift & Co., L. W. Rowell, vice-president in charge of fertilizer production, retired on January 1st under the Company's retirement plan. Mr. Rowell entered the Swift organization in 1895 as a clerk in the Kansas City branch. He was Assistant Department Manager in Chicago from 1907 to 1918, Department Manager 1918 to 1928, Vice-President of Swift & Co. Fertilizer Works 1928 to 1933, at which time he was elected President and Director of the Fertilizer Works and a Vice-President of Swift & Co.

For many years Mr. Rowell has taken an active part in the affairs of the industry for many years. He has been a Director of the National Fertilizer Association and from 1929 to 1932 served as President during the grave days at the beginning of the depression. His competent leadership brought the Association through these trying times in spite of a reduction of more than 60 per cent in the Association's revenue. He will be greatly missed in the deliberations of the coming war and postwar years.

November Sulphate of Ammonia

The production of sulphate of ammonia during November declined 6.7 per cent from the October figures, according to the U. S. Bureau of Mines. Production fell almost below the 2,000 tons per day which has been maintained for quite some months. Shipments, on the other hand, increased by more than 14,000 tons over October and as a result stocks on hand at the end of November totaled only 33,705 tons, the lowest level for quite some time. The figures for ammonia liquor production showed a similar decrease, although shipments remained at about the same quantity as during the previous month.

	Sulphate of Ammonia Tons	Ammonia Liquor Tons NH_3
Production		
November, 1943	60,927	2,744
October, 1943	65,341	2,915
November, 1942	62,907	2,900
January-November, 1943	696,491	31,192
January-November, 1942	702,993	31,058
Shipments		
November, 1943	72,528	2,912
October, 1943	58,401	3,092
November, 1942	68,284	3,017
Stocks on hand		
November 30, 1943	33,705	939
October 31, 1943	44,957	983
November 30, 1942	49,924	1,034
October 31, 1942	55,447	1,016

Del-Mar-Va Association Holds Winter Meeting

The annual Winter Meeting of The Del-Mar-Va Peninsula Fertilizer Association was held in Salisbury, Md., on December 13th.

In discussing their problems, the scarcity of organics was disclosed as the bottleneck that is holding up fertilizer production. This is the largest single reason for the manufacturing difficulty.

The labor situation is serious also. The National Fertilizer Association has recently sought government aid in meeting some of the manpower problems of the fertilizer industry. Results produced were not satisfactory.

Other important matters discussed were relative to the new Government rules, regulations, restrictions, quotas, allocations, priorities, rationing, etc. Many of the subjects were somewhat complicated, with measures requiring a form of compliance sometimes difficult to easily follow. But they are all war measures, and as such will have the full support of all concerned.

Officers elected were: John L. Morris, Wm. B. Tilghman Co., Salisbury, president; Dallas W. Culver, Huston-Culver Company, Seaford, vice-president; Warner W. Price, Warner W. Price Co., Smyrna, Del., secretary; Elbert E. Carvel, Valiant Fertilizer Co., Laurel, Del., treasurer.

Peas Require Judicious Fertilization

U. S. D. A. Farmers' Bulletin 1920 gives fertilizer recommendations for growing peas for canning and freezing. It points out that judicious use of fertilizers in connection with good cultural practices will usually be a distinct aid in producing a good crop of peas. Owing to their nitrogen-gathering properties, peas may add to the supply of this element in the soil. In nearly all localities, however, moderate applications of nitrogen are beneficial. The experience of good growers indicates that the use of a fertilizer containing 4 to 5 per cent nitrogen, 8 to 12 per cent phosphoric acid, and 3 to 6 per cent potash, applied at the rate of 300 to 600 lbs. per acre, will be satisfactory. On soils particularly deficient in any one element, those mixtures containing a higher percentage of that element should be used. Farmers are advised not to drill the seed and fertilizer together. In general, the authorities say it is much safer to drill fertilizer into the soil before sowing the seed.

Prindeville to Head Swift Fertilizer Business

C. T. Prindeville, vice-president of Swift & Co., has been appointed director of the fertilizer business of Swift & Co., succeeding L. W. Rowell who retired on January 1st.

Mr. Prindeville was called to Washington with the War Department early in 1942. The following August he was transferred to the War Production Board, in charge of edible fats and oils. With the creation of the War Food Administration, fats and oils, along with other foods, were transferred to it and later Mr. Prindeville became chief of the fats and oils branch, handling soap and glycerine as well as edible and inedible fats and oils. He was the American representative on the fats and oils committee of the Combined Food Board.

Mr. Prindeville, the fourth generation of his family in Chicago, is a graduate of Harvard University. He joined Swift & Company's staff in 1921 and was elected vice-president in 1941. Prior to entering Government service in 1942 he was in charge of Swift's cottonseed and soybean mills and peanut shelling plants.

FERTILIZER MATERIALS MARKET

NEW YORK

Sulphate of Ammonia Appears to Be Ample for Domestic Needs with Supplies Available for Export. Potash Production Holds Up Well but Increased Allocations Doubtful. Labor Shortage and Lack of Sulphuric Acid Curtails Superphosphate.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, December 28, 1943.

Ammonium Sulphate

Shipments are being made regularly, taking care of production fairly well, but it is generally understood that ample supplies are available for shipment against export orders if necessary license and allocation can be obtained.

Ammonium Nitrate

Deliveries are continuing in larger quantities.

Nitrate of Soda

There has been no difficulty in filling allocations previously given as the supply situation seems to be well sustained.

Potash

In spite of the labor situation, potash manufacturers have managed to maintain production, but it does not look as though there will be any additional material available during the second period. There has been a call for material for the filling of some additional small orders for export, but the quantities are such that it has not affected the over-all picture to any extent. Probably allocations will be made for the third period, during February, but it is doubtful if the buyers will receive any more than the anticipated quantities for this period.

Superphosphate

Production continues in large quantities but in certain parts of the country lack of sulphuric acid has curtailed the quantity to some extent. Demand continues heavy.

Phosphate Rock

Heavy shipments have continued, and the demand remains heavy. There is no lack of material, but the labor situation is the factor that is worrying producers.

CHARLESTON

Shortage of Raw Materials Handicaps Nitrogenous Production. Feed Market Taking Most Supplies of Other Organic Materials

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, December 27, 1943.

Manufacturers report that orders from farmers have stepped up appreciably in the past 30 days.

Organics.—While customers who are covered by contracts are receiving what they have bought, the producers of nitrogenous materials are hard put to it to make shipments on account of the shortage of raw materials. No new contracts are being made as yet.

Castor Pomace.—Heavy arrivals of beans continue to come in, but producers are only able to take care of old contracts for castor meal.

Blood.—Nothing new on this material, all arrivals are going into feed and it is now difficult to obtain supplies in the Argentine as Great Britain has been willing to pay better prices.

Bone Meal.—All available productions are going into feed, no supply being offered for the fertilizer trade.

PHILADELPHIA

Demand Good and Supplies Scarce. Interest Centers in Production Figures. Farmers Taking Early Deliveries of Fertilizer Purchases.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, December 28, 1943.

The situation still prevails that has held forth for the past couple of years—demand good and supplies scarce. Thus, we find that principal interest centers on production figures, for everyone in the trade is hoping—and working—for increased production, in order to take care of all who require agricultural chemicals and raw materials.

It has been noted—with pleasure by mixers—that the farmers are taking delivery of mixed goods now, thus relieving storage space.

FERTILIZER MATERIALS

LET US QUOTE YOU ON YOUR REQUIREMENTS OF THESE MATERIALS

✣

PHOSPHATE ROCK

✣

SUPERPHOSPHATE

✣

DOUBLE SUPERPHOSPHATE

✣

SULPHURIC ACID

✣

BONE MEALS

✣

DRIED BLOOD

✣

TANKAGES

✣

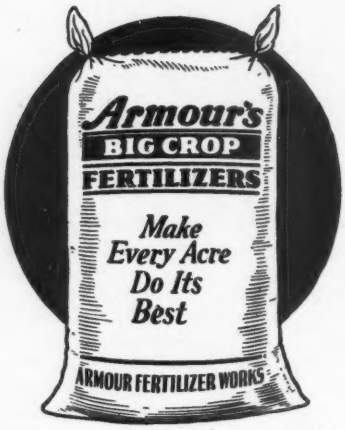
BONE BLACK

✣

PIGMENT BLACK

✣

SODIUM FLUOSILICATE



ARMOUR FERTILIZER WORKS

General Offices: Walton Building, Atlanta, Ga.

Division Sales Offices:

Albany, Ga.
Atlanta, Ga.
Augusta, Ga.
Baltimore, Md.
Birmingham, Ala.
Chicago Heights, Ill.
Cincinnati, Ohio
Columbia, S. C.
Columbus, Ga.
East St. Louis, Ill.
Greensboro, N. C.
Havana, Cuba
Houston, Texas
Jacksonville, Fla.
Montgomery, Ala.
Nashville, Tenn.
New Orleans, La.
New York, N. Y.
Norfolk, Va.
Presque Isle, Me.
San Juan, P. R.
Sandusky, Ohio
Wilmington, N. C.

The goal is to get more farmers to do likewise.

Ammoniates.—Of course, the inorganic materials are under allocation (and some are allocated fairly freely), while the organic materials remain scarce.

Sulphate of Ammonia.—Being allocated at full 100 per cent for industrial purposes. Production seems to remain in step with the demand.

Nitrate of Soda.—Production holding up well, and this material is also being allocated in full.

Superphosphate.—While the over-all production picture appears good, some local shortages have been reported.

Bone Meal.—Situation remains about the same—demand heavy and supply light.

Potash.—Allocations were being met, and production holds up well.

CHICAGO

Demand Good for Fertilizer Organics. Little Hope of Increased Supplies. Feed Orders Being Allocated by Mixers.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, December 27, 1943.

The paucity of organic offerings still manifests itself, and the prospects of increased offerings in the near future appear very dubious. In the meantime, demand at ceiling prices continues good.

In the finished feed market, open offerings are virtually at a complete standstill. Mixers are allocating orders to the best of their ability.

Ceiling prices in feed as well as organics are well maintained.

High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.86 per unit N) and 10 cents; standard grades crushed feeding tankage, $5.53 per unit ammonia ($6.72 per unit N); blood, $5.38 ($6.54 per unit N); dry rendered tankage, $1.21 per unit of protein, Chicago basis.

Davies Joins WFA Staff

Thomas W. Davies, of Columbia, S. C., has joined the staff of the Chemicals and Fertilizers Branch, OMF, WFA, and will cooperate with Mr. Lafkin in connection with WFA fertilizer orders and with Mr. Watkins in the fertilizer requirements program. Mr. Davies has had many years' experience in the fertilizer business, having been associated most recently with the Potash Company of America for about six years and prior to that time with The Barrett Company for about three years.

Fertilizer for Field Beans

Cornell Bulletin 776, "Experiments With Field Beans," reports results of a 2-year fertilizer experiment on Dunkirk silty clay loam soil at Ithaca, New York. Several conclusions from this experiment seem plausible. Beans are likely to respond better to nitrogen than to either phosphorus or potash when the crop is grown on land that was liberally fertilized with a complete mixture the previous year. The reason for this is that both phosphorus and potash are more likely to be carried over in the soil as residual fertilizer than is nitrogen. Very little commercial fertilizer should be necessary for beans when they follow some other well-fertilized crop. Even though neither phosphorus nor potash was profitable in these experiments, complete mixtures are recommended in order that the nutrient requirements of the crop will be safeguarded in every situation. Apparently, applications of 200 to 500 lbs. per acre of such analyses as 4–12–4 and 6–18–6 are justified on all but the very light soils, where a higher ratio of potash is suggested. Marked increases in yield are sometimes obtained from the use of as little as 200 to 300 lbs. per acre of complete fertilizer.

A STATEMENT OF IMPORTANCE

DESIGNED TO EASE THE SITUATION

FOR EVERY USER OF

MULTIWALL PAPER BAGS!

AS you know, multiwall paper bags are doing an important job of war-time packaging. Hundreds of chemicals and agricultural products formerly shipped in wood, metal or fabric; vastly increased volume of standard food products normally shipped in paper; quantities of essential cement and other construction materials which must move on schedule, and government requirements for multiwall paper bags for overseas shipments . . . all these result in an unprecedented production problem for our industry.

Fortunately, both raw material supply and bag manufacturing facilities are ample, but the *purchaser* and the *producer* of bags must work together, so that the full productive potentialities may be realized for the good of all concerned.

With this objective in mind, we suggest every possible move toward bag simplification. Your cooperation will speed production and delivery, and enable multiwall bag manufacturers to produce vastly increased quantities.

Some of the factors which tend to retard production are:

1. Excessive ink coverage, or multicolor printing when one or two colors would suffice;
2. [a] Use of tuck-in sleeves when L.C. sleeves would be adequate; [b] use of any type of sleeve if not absolutely necessary;
3. Variations in depth of notch cuts;
4. Thumb-cut, interply pasting, and gusset pasting;
5. Specifying a variety of sizes, composed of differences of one or two inches or less in bag width or length. Standardization of bag sizes might prove practical in your plant operation;

and, perhaps most important, you can ease the situation by:

A. Anticipating your bag requirements;
B. Keeping inventory at a minimum.

There are many cases where any or all of these and other special features are necessary. This is addressed to those users of bags who *can* dispense with any of them in time of war. Every move toward bag simplification [even at some temporary inconvenience to bag users] helps accelerate and increase production of these important containers.

May we suggest that you give consideration to this goal of bag simplification and standardization on present and future orders! Manpower limitations make it impossible for us to call on every customer immediately, but our representative will call to discuss your specific situation as soon as possible. In the meantime, any immediate action on your part will be most helpful.

For St. Regis Paper Company, we pledge a continuance of the complete cooperation of every man and woman in the organization to make every possible effort in the interest of producing good bags in sufficient quantities to meet the needs of Government and industry.

St. Regis Makes Important Timber Purchase

"A tremendous step has been taken toward solving the nationwide paper shortage, particularly in the field of paper containers," said Roy K. Ferguson, President of St. Regis Paper Company, in announcing the purchase of all logging operations of the West Fork Timber Company, Lewis County, Washington, and the acquisition of perpetual cutting rights to the 109,000 acres of timber land owned and controlled by that company. Mr. L. T. Murray, President of the West Fork Timber Company, one of the outstanding figures in the logging industry, will become associated with St. Regis Paper Company. This is said to be the biggest transaction in the timber field in more than 25 years. Coming at a time when the shadow of shortage threatens the entire part that paper and paper containers play in the conduct of the war at home and abroad, this timber will be converted into pulp at the Tacoma, Washington, mill of St. Regis Paper Company and then used for the manufacture of specification kraft paper, largely for conversion into multiwall paper bags for shipment of foodstuffs, chemicals and construction materials to maintain civilian economy at home and for the support of armed forces and Allied civilian populations abroad.

The tract, which is one of the largest stands of fir and hemlock in the country, is 45 miles from the Tacoma pulp mill. The magnitude of the acquisition can be more fully appreciated when it is recognized that St. Regis now owns and controls more than five billion standing feet of timber in the Pacific Northwest.

For eight years selective logging has been the basis of operation. Continuation of this modern and scientific method by St. Regis will insure the retention of all of the natural beauty and utility of this vast tract, and at the same time guarantee millions of feet of the same high quality timber for generations to come.

The critical wood situation during 1942 made it necessary for the War Production Board to issue order M-251, which established Government control of all logs and resulted in withholding supplies from the St. Regis mill at Tacoma, Wash., as well as curtailing the operations of Rayonier, Scott Tissue and other pulp mills in the Northwest. This West Fork timber not only assures St. Regis ample supplies of pulpwood in perpetuity, but the reopening of the Tacoma pulp mill, which is expected to take place within the next sixty to ninety days, will enable St. Regis to meet the increased demand for pulp, which will result in additional specification kraft paper being available to other bag factories, as well as to the twelve bag plants of the St. Regis Paper Company.

An additional 100,000 tons of pulp will be made available annually as a result of the reopening of the Tacoma mill which will be under the direction of Mr. Walter DeLong, Vice-President of the St. Regis Paper Co. Translated into bag production this would supply sturdy shipping sacks to package upwards of nine million tons of flour, feed, sugar, salt, fertilizer, chemicals, cement, lime and other commodities for domestic and export shipment.

The acquisition of these timber rights, the recent construction of a bag plant in Kansas City and the increased use of new protective papers are all in line with the St. Regis Paper Company policy of making multiwall bags available to do a vital wartime job, and at the same time gearing production facilities to handle industry's post-war requirements.

BACK TO BUMPER CROPS WITH 'AERO' CYANAMID WHEN WAR ENDS . . .

Many successful farming practices have been laid aside due to the Cyanamid shortage, which was brought about by the demands of war.

Farmers and growers still want their normal requirements of 'Aero' Cyanamid for "plow under" with cover crops and other specialized uses. They know what it means to be without "Agriculture's most useful form of Nitrogen."

The combination of nitrogen and lime in Pulverized and Granular 'Aero' Cyanamid commands the attention of producers of mixed fertilizers. New materials in the mixing industry have emphasized the need for the oldest and most satisfactory conditioner — Pulverized 'Aero' Cyanamid.

AMERICAN CYANAMID COMPANY

Fertilizer Division

30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

Care of Chain Belt Drives

"Wartime Care of Chain Belt Drives" is a booklet just published by the Chain Belt Company giving information on maintenance, lubrication and repair of chain belt drives during these wartime days.

Chain belt drives, as well as other equipment, are working longer hours at a harder pace than ever before. The booklet was produced with the idea of helping users to get the most out of their existing drives and save some costly delays and unnecessary expense. It may be obtained by writing Chain Belt Company, 1600 West Bruce Street, Milwaukee 4, Wisconsin.

Tomato Fertilizer Experiments

New Jersey Experiment Station Circular 443 entitled "Tomatoes in the Greenhouse" discusses varieties, disease and insect control, harvesting and packing, pruning, pollination, soils, value of hormone sprays, and particularly the value of liquid fertilizers. Liquid fertilizers, according to the authors, provide the best means of feeding greenhouse tomatoes. They recommend a 5–10–5, 10–20–10, or 13–26–13 as suitable grades. Ten lbs. of such grades in 50 gallons of water would make a good application for a feeding, using 4 gallons to 100 square feet of soil every two weeks. They point out the importance of maintaining a high level of limestone in the soil at all times.

Results of an experiment to determine the most desirable method of applying fertilizers to tomatoes were reported to the Peninsula Horticultural Society in 1942. Of the five fertilizer-placement treatments employed in this experiment the highest yield, and therefore the most favorable treatment, appeared to be where the fertilizer was plowed down. In commenting on the experiment, Professor E. P. Brasher, Delaware Experiment Station, says that when plowing down fertilizer in preparation for a crop of tomatoes, it is desirable to apply at least 1,000 to 1,200 lbs. per acre, using a starter solution at planting time, in order to keep the plants in a vigorous condition until the roots penetrate far enough to reach the main supply of fertilizer.

POTASH IN WAR PRODUCTION

(Continued from page 8)

of the entire State area, or 5,200,000 acres, one-half of which or 2,600,000 acres is under cultivation. Using the data from the eight experimental fields located in this section of the State and the per acre rate of 50 pounds of K_2O used in these experiments with the grain system of rotation—corn, soybeans, and wheat—the results show a net increase of 32.5 per cent in crop value attributable to the potash alone. In other words, with potash, each 100 acres yield crop volumes for which 132.5 acres would be required without potash. Thus, from the use of 125,000 tons of K_2O, the crop-producing equivalent of this acreage already under cultivation could be increased to 3,445,000 acres. Here are crops of great food value produced at the high per-acre rates that have won for the North-Central tier of states the designation of "the Nation's breadbasket." In these Illinois results are other data of great significance. Comparing the yields from complete fertilization with county averages we find: 112 bushels of corn vs. a county average of 42; 72 bushels of oats vs. 34; 34 bushels of wheat vs. 21; and 2.5 tons of clover-alfalfa hay vs. 1.7.

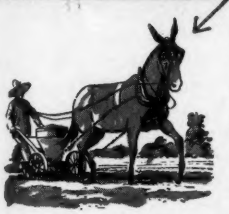
Equally significant data have been obtained from other states.

Maine has 200,000 acres in potatoes. If the additional 80 pounds of K_2O per acre recommended by Chucka were available, amounting to 8,000 tons of K_2O, the increased yield would amount to 2.4 million bushels.

In North Carolina, with 100,000 acres in potatoes, at 60 pounds of K_2O per acre or a total of 3,000 tons of K_2O additional, the increased yield would be 1.2 million bushels. In that State, 300,000 acres are in peanuts: with 15 pounds of K_2O per acre or 2,300 tons of K_2O, the increased yield would amount to 10.1 million pounds. With 40 pounds of K_2O applied to 850,000 acres of sweet potatoes, requiring 1,700 tons of K_2O, an additional 1.7 million bushels could be produced.

North Carolina has 850,000 acres in cotton. With the next increment of 20 pounds of K_2O recommended, totaling 8,500 tons of K_2O, the increase resulting would be 24.7 million pounds of lint, 9.9 million pounds of oil, and

America's market basket depends on soil fertility



Vegetable crops remove relatively large amounts of potash from the soil. This vital plant nutrient must be replaced in order to insure both quantity and quality. And this has an important bearing on the mixing of fertilizers intended for use on these crops. The American farmer is doing a bigger job than ever... and doing it magnificently! He's counting on your fertilizers to help him raise the bumper crops needed to feed our fighters, civilians and Allies. Your fertilizers, most of them compounded with potash, help plants to resist disease and drought.

Sunshine State Higrade Muriate of Potash, and other grades which you know, are of tremendous help in keeping America's market basket brimming over with the foods needed to hasten Victory.

TRADE-MARK REG. U. S. PAT. OFF.

HIGRADE MURIATE OF POTASH 62/63% K_2O GRANULAR MURIATE OF POTASH 48/52% K_2O MANURE SALTS 22/26% K_2O

SUNSHINE STATE POTASH COMPANY

17.25 million pounds of cottonseed meal; while in the adjoining state of South Carolina, with 1,100,000 acres in cotton and with an increment of 15 pounds of K_2O per acre, totaling 8,200 tons of K_2O, the increased yield would be 46.2 million pounds of lint, 18.5 million pounds of oil, and 32.3 million pounds of cottonseed meal. Your attention is called particularly to these yields of vegetable oil and concentrated animal feed, essential products too often overlooked in placing all emphasis on the lint because of its major importance among vegetable fibers.

Returning to the Midwest, Indiana has 4,300,000 acres in corn, for which 30 pounds of K_2O per acre is recommended. If the 64,500 tons of K_2O required were at hand, the increased yield would amount to 43 million bushels. Similarly for wheat, 1,100,000 acres at 20 pounds of K_2O per acre requiring 11,000 tons of K_2O, the increased yield would be 3.3 million bushels. Indiana has 50,000 acres in tomatoes. At 30 pounds per acre as the next recommended increment, only 800 tons of K_2O would be required but the increased yield would be 400 million pounds.

The fertilized pasture of legumes or mixed grass and legumes is now recognized as the cheapest and the most important and labor-saving source of forage for livestock and dairy herds, of great importance in our war effort. Under New Jersey conditions, for example, 1 pound of K_2O yields 14 pounds dry weight of grass-clover, or 36 pounds dry weight of ladino clover hay, equivalent, respectively, to 8.4 and 21.6 tons of hay per ton of 60 per cent muriate.

Such are the data obtainable from our experiment station records, typical of a great mass subject to similar analysis if more evidence were needed to show the importance of potash in balanced crop nutrition. Potential increases unrealized represent losses from the aggregate farm effort. They represent losses in income to the individual farmer. At the current South Carolina price of 21c per pound for cotton lint and $50 per ton for cottonseed, a ton of 60 per cent muriate of potash has a gross value of $1,345 in terms of increased crop yields. That is what the cotton farmer stands to gain as the result of an adequate supply. Similar calculations for the other increases cited above serve to show that the wholesale price of $28.50 per ton of 60 per cent muriate is a wholly inadequate expression of value as it relates to our agricultural economy.

These figures are official and are circumscribed by the usual variables encountered in experimental work. They have been chosen in terms of their accessibility. They are not exceptions, many of them being ten-year averages. If the totals appear sensational it is because we have had little occasion heretofore to project per acre values into the realm of state-wide crop production efforts.

Most Efficient Use of Supplies

Never before in our history have we been called upon for such an agricultural effort as that in which we are now engaged. Its magnitude and the penalties of failure are such as fully to justify a close scrutiny of every pertinent factor and to deal realistically with those that block our success. We are now told that it is beyond our capacity to become the "world's breadbasket" for the duration of the war and the reconstruction period. A consideration of what that may mean in terms of human misery spurs us to greater effort, not despair. It was our ambition to become the "arsenal of democracy," under which generous impulse was made the Lend-Lease allocation of potash salts, the major cause of our present deficit in supply. The degree to which its adverse effect on North American production was weighed against its favorable effect on English production has not been disclosed. Since this allocation was granted, Allied success in opening the Mediterranean has vastly increased the accessibility of potash supplies from both Palestine and Spain, while Russian supplies are no more remote. Cargo space has been greatly augmented and the U-boat menace reduced. Great progress has been made in the dehydration of the bulkier food products. Accordingly, there does not appear to be any cogent reason why this Lend-Lease allocation should not be reviewed in the same fine cooperative spirit in which it was granted. The conclusion seems obvious that the most immediate and effective way to overcome this deficit in potash supply is to secure British requirements from sources less intimately related to North American food-production

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capacity. The sole proper issue is—Where will this tonnage best promote the war effort?

In seeking the most efficient use of the limited supplies of nitrogen, phosphorus, and potassium at our disposal, we are fortunate that we have the information provided by the agronomists as to the most efficient combinations of the three: plant-food ratios as recommended by State authorities. These are based on a half-century of research, experimentation, and demonstration, and relate not only to per acre rates of application but also to the interdependence of the three plant foods in yielding the maximum efficiency of each individually and of the three in combination. The ratio recommended being the most efficient, in light of present information, to change that ratio results in the loss of efficiency of each plant food individually and of the combination. We are all familiar with "induced deficiencies" resulting from unbalanced ratios. It seems clear, therefore, that we are guilty of a gross fallacy when we attempt to juggle grades to fit the supply situation instead of the crop requirement; it is efficient crop production that will promote the war effort and not just tons of fertilizer. The War Food Administration has designated the preferred crops and has assigned them priorities. The more logical procedure would appear to be to juggle rates of application in terms of these priorities instead of sacrificing the efficiency of the ratios applied. These ratios are the foundation of our fertilizer industry. They are the scientific basis without which we would immediately become the vendors of patent medicine types of products. There has been no time in American history when we had greater need than now to apply the best we have in agricultural science.

Nor can one find any promotion of the war effort in reducing the plant food content of fertilizer mixtures, even though the approved ratio may be retained. It is obvious that with the current exportation to England of 152,000 tons out of a total production of 275,000 tons of concentrated superphosphate, in addition to the proposed exportation of potash, some of the most concentrated mixtures can no longer be made. This refers to the 40 per cent or better grades and not the 20 per cent or poorer grades. The reduction of the plant-food content of the mixture automatically increases the content of the inert, whether that be filler or the unavoidable constituent of the plant-food carrier. Substituting filler for plant food requires more labor and bags in the mixing plant, more space in boxcars and trucks, more gas and rubber for trucks and tractors, and more farm labor to distribute. This is contrary to public policy. Rationing is now a familiar phenomenon of our wartime existence, but the policies pertinent thereto do not contemplate the dilution of the commodities rationed. In the words of one well-known agronomist, "It doesn't take much sand to satisfy the silica requirements of the average crop!"

Such, then, are some of the implications of a 10 per cent deficit in potash supply for American agriculture, serious in its repercussions on that essential war industry.

Potash in Chemical Industry

Turning now briefly to our chemical industry, we have noted an allocation of 85,000 tons of K_2O as compared to the 67,300 tons delivered during the 12-month period, June to May 1942–43. This is a wartime increase from 15,000 tons of K_2O delivered during the last prewar year, 1938. These increases are due to expansions in peacetime manufacture of the many products using potash chemicals; to the replacement of imports, notably the chlorates; to the manufacture of munitions, as, for example, potassium nitrate; to the military needs for peacetime products, such as the superior potash glasses for optical and precision instruments. Superimposed are new uses, still more or less shrouded in secrecy, in the metallurgical industries, notably magnesium and aluminum, in the production of high-octane gasoline, and in the synthetic rubber industry. Rumors relate to mysterious new and enlarged uses for the perchlorate and the persulfate. New compounds such as the pentaborate and potassium zinc chromates appear on the list of industrial chemicals. New metaphosphates for industrial use are under development.

These new uses and expansion in the old show promise of permanence. There appears to be no logical reason why we should return to foreign sources of supply with the abandonment of our own. Chlorate and nitrate were our principal chemical imports in the category of potash chemicals. While our present potassium nitrate industry to a considerable extent at least depends on the old process of double decomposition of sodium nitrate and potassium chloride, the newer technologies for this manufacture are being widely discussed as a postwar outlet for our more abundant supplies of synthetic ammonia, from the fertilizer rather than the chemical viewpoint, however, for the agricultural value of potassium nitrate is thoroughly well established and represents a large potential demand.

BUYERS' GUIDE • A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMONIUM NITRATE SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

AUTOMATIC ELEVATOR TAKEUPS
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill.
Union Bag & Paper Corporation, New York City.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Textile Bag Mfrs. Association, Chicago, Ill.

BAGS—Paper
Bagpak, Inc., New York City
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Union Bag & Paper Corporation, New York City.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.
St. Regis Paper Co., New York City.
Textile Bag Mfrs. Association, Chicago, Ill.
Union Bag & Paper Corporation, New York City.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

BAG CLOSING MACHINES
Bagpak Inc., New York City.
St. Regis Paper Co., New York City.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
St. Regis Paper Co., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

BAG PILERS
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BELTING—Leather, Rubber, Canvas
Sackett & Sons Co., The A. J., Baltimore, Md.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Dickerson Co., The, Philadelphia, Pa.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Link-Belt Company, Philadelphia, Chicago
Sackett & Sons Co., The A. J., Baltimore, Md
Stedman's Foundry and Mach. Works, Aurora Ind

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BUYERS' GUIDE

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BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag Line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.

CASTINGS—Iron and Steel
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.

CHEMICALS—Continued
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.
Dickerson Co., The, Philadelphia, Pa.
Phosphate Mining Co., The, New York City.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.

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DISINTEGRATORS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DRYERS—Direct Heat
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link Belt Speeder Corp., Chicago, Ill., and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Company, New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Company, Columbus, Ohio.
International Minerals and Chemical Corporation, Chicago, Ill.
Phosphate Mining Co., The, New York City.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utillty Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind

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MACHINERY—Power Transmission
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.
Duriron Co., Inc., The, Dayton, Ohio.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Division, The, Allied Chemical & Dye Corp., New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGEN SOLUTIONS
Barrett Division, The, Allied Chemical & Dye Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Coronet Phosphate Co., New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Phosphate Mining Co., The, New York City.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Virginia-Carolina Chemical Corp. (Mining Dept.), Richmond, Va.
Wellmann, William E., Baltimore, Md.

PIPE—Acid Resisting
Duriron Co., Inc., The, Dayton, Ohio.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
International Minerals & Chemical Corp., Chicago, Ill.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Duriron Co., Inc., The, Dayton, Ohio.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., New York City.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

ROUGH AMMONIATES
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

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SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Hayward Company, The, New York City.

SCREENS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Including Vibrating
Sackett & Sons Co., The A. J., Baltimore, Md.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corporation, Chicago, Ill., and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

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Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Jett, Joseph C., Norfolk, Va.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
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